Assessment of Air Quality in the International Space Station (ISS)
Based on Samples Returned by Soyuz in November 2001

The toxicological assessment of 2 grab sample canisters (GSCs) returned aboard Soyuz is reported. The samples, which were taken from the FGB and Lab on 13 September 2001, were given early return to better understand the high methanol concentration found in the FGB sample from 6 August 2001. Analytical methods have not changed from earlier reports, and surrogate standard recoveries were 79-106%. Pressure tracking indicated no leaks in either canister.

The two general criteria used to assess air quality are the total-non-methane-volatile organic hydrocarbons (NMVOCs) and the total T-value (minus the CO_2 and formaldehyde contribution). Because of the Freon 218 (octafluoropropane, OFP) leak, its contribution to the NMVOC is indicated in brackets. When comparing the NMVOC values with the 25 mg/m^3 guideline, the OFP contributions should be subtracted. Control of atmospheric alcohols is important to the water recovery system engineers, hence total alcohols were also assessed in each sample. Formaldehyde is quantified separately. These five indices are summarized below:

Sample Location	Date/Type	NMVOCs (mg/m^3)	[OFP] (mg/m^3)	T Value[a] (units)	Alcohols (mg/m^3)	Formaldehyde (mg/m^3)
FGB-GSC	8/06/01	140	[61]	8.47	74.4	ns[b]
FGB-GSC	9/13/01	340	[332]	0.96	4.9	ns
Lab-GSC	9/13/01	341	[334]	0.90	3.6	ns
Acceptable Guideline>>>		<25	[85000]	<1	<10	0.050

[a] Formaldehyde and CO2 not included in T calculation.
[b] ns = not sampled

The FGB sample contained a much lower concentration of methanol (2.1 mg/m3) than the one from August (71 mg/m3); however, the result from September was somewhat higher than usual. The concomitant sample in the Lab showed typical levels of methanol (0.5 mg/m3). All other pollutants were found at comparable concentrations in the two September samples. This clearly suggests a local, short-lived source of methanol in the FGB, but with much less impact on the September sample than on the August sample.

Freon 218 was found at unprecedented concentrations in both samples. Both concentrations were far below the 180-day SMAC; however, these data do suggest an ongoing leak in one of the coolant loops using this heat-exchange fluid. Since concentrations were much lower in the August samples, it appears that efforts to scrub this material from the atmosphere have been overwhelmed by further leaks.

Since both T values were less than 1.0, the atmosphere meet acceptable standards for crew health at the time and location of sampling as specified in the Medical Operations Requirement Document, Revision A. Due to the long interval (38 days) between the August and September samples, one cannot conclude much about total crew exposures to either methanol or Freon 218.

Enclosures
1: Analytical Results of Air Samples Returned on Soyuz in November 2001
2: T Values of Air Samples Returned on Soyuz in November 2001